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Cover image
Canoeing on the Touws River
by Sue Matthews

Acid: The bottom end of the scale

Our cover photo shows a couple canoeing on the Touws River, having paddled upstream from the Ebb and Flow Rest Camp in the Wilderness section of the Garden Route National Park. The Touws River is one of the blackwater systems of the southern Cape, with dark, naturally acidic waters due to the presence of plant-derived humic acids and the influence of the underlying rock and soil.

In fact, rivers along much of South Africa's coast are naturally acidic to varying degrees because they flow over sandstone-derived soils. By contrast, many rivers in inland areas flow through areas with dolerite-derived soils, where calcium carbonate and magnesium carbonate dissolved in the water raises the pH, resulting in alkaline water. The high concentration of calcium and magnesium cations make this mineral-rich 'hard water', while the acidic waters of the Cape are considered 'soft' because the concentration of calcium carbonate is below 60 mg/L.

What are the implications of naturally acidic rivers for our water supplies? The gastric acid in our stomach is typically more acidic than water we might drink directly from a river, and most people are able to consume acidic citrus juices and carbonated beverages without ill effect. But water that is supplied by municipalities and water boards must be treated, and both the colour and the low pH present problems for the water treatment process that need to be addressed.

Water is treated to destroy microorganisms that could be harmful to consumers, to remove suspended solids, and to ensure its chemical composition is not damaging to the distribution system. Acidic, soft water may not only corrode water pipes and reservoirs, but also contaminate the supply with dissolved metals that might be dangerous to human health and will affect the water's taste.

The humic acids and other organic compounds imparting the dark colour must first be removed or they would react with the chemicals used for disinfection, such as chlorine, calcium hypochlorite, ozone or hydrogen peroxide. This would reduce the effectiveness of treatment while also increasing the concentration of disinfection by-products, many of which are toxic. Removal is achieved by coagulation and flocculation – adding chemicals that cause particles to clump together into aggregates large enough to settle out or to be filtered out.

Before or after disinfection, the water must be 'stabilised' before it enters the distribution system. The pH is raised by adding lime so that the water is slightly supersaturated with calcium carbonate ($CaCO_3$), which causes $CaCO_3$ to precipitate out and form a thin 'eggshell' layer on the surface of concrete pipes, protecting them from corrosion. If the water is then too alkaline, carbon dioxide (CO_2) is bubbled through the water to adjust the pH.

Of course, apart from the naturally acidic rivers and streams in South Africa and other countries, all watercourses as well as soils, plants, animals and even our oceans can be affected by human-induced acidification. This may be caused by diffuse sources such as rising CO_2 levels resulting in acid rain and ocean acidification, or point sources such as pipeline discharge of industrial effluents, or both as in the case of acid mine drainage. In this issue of *Quest*, we explore various naturally acidic environments and types of human-induced acidification, and consider the various implications.

Sue Matthews
Quest Editor

Isihloko salesiqephu se *Quest* simayelana ne asidi. Sigxila kwizindawo ezine asidi ngokwemvelo noma ngenxa yomshikashika wabantu.

Translated by Zamantimande Kunene

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